



# Aviation Investigation Final Report

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<b>Location:</b>	Chanute, Kansas	<b>Accident Number:</b>	CEN12FA290
<b>Date &amp; Time:</b>	May 11, 2012, 16:30 Local	<b>Registration:</b>	N9DM
<b>Aircraft:</b>	Cessna 401	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>	Miscellaneous/other	<b>Injuries:</b>	4 Fatal, 1 Serious
<b>Flight Conducted Under:</b>	Part 91: General aviation - Personal		

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## Analysis

While en route to the destination airport, the pilot turned on the cabin heater and, afterward, an unusual smell was detected by the occupants and the ambient air temperature increased. When the pilot turned the heater off, dark smoke entered the cabin and obscured the occupants' vision. The smoke likely interfered with the pilot's ability to identify a safe landing site. During the subsequent emergency landing attempt to a field, the airplane's wing contacted the ground and the airplane cartwheeled. Examination of the airplane found several leaks around weld points on the combustion chamber of the heater unit. A review of logbook entries revealed that the heater was documented as inoperative during the most recent annual inspection. Although a work order indicated that maintenance work was completed at a later date, there was no logbook entry that returned the heater to service. There were no entries in the maintenance logbooks that documented any testing of the heater or tracking of the heater's hours of operation. A flight instructor who flew with the pilot previously stated that the pilot used the heater on the accident airplane at least once before the accident flight. The heater's overheat warning light activated during that flight, and the heater shut down without incident. The flight instructor showed the pilot how to reset the overheat circuit breaker but did not follow up on its status during their instruction. There is no evidence that a mechanic examined the airplane before the accident flight. Regarding the overheat warning light, the airplane flight manual states that the heater "should be thoroughly checked to determine the reason for the malfunction" before the overheat switch is reset. The pilot's use of the heater on the accident flight suggests that he did not understand its status and risk of its continued use without verifying that it had been thoroughly checked as outlined in the airplane flight manual. A review of applicable airworthiness directives found that, in comparison with similar combustion heater units, there is no calendar time limit that would require periodic inspection of the accident unit. In addition, there is no guidance or instruction to disable the heater such that it could no longer be activated in the airplane if the heater was not airworthy.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The malfunction of the cabin heater, which resulted in an inflight fire and smoke in the airplane. Contributing to the accident was the pilot's lack of understanding concerning the status of the airplane's heater system following an earlier overheat event and risk of its continued use. Also contributing were the inadequate inspection criteria for the cabin heater.

### Findings

<b>Aircraft</b>	Heating system - Malfunction
<b>Personnel issues</b>	Understanding/comprehension - Pilot
<b>Organizational issues</b>	Adequacy of policy/proc - FAA/Regulator

## Factual Information

### History of Flight

<b>Enroute-cruise</b>	Miscellaneous/other (Defining event)
<b>Enroute-cruise</b>	Emergency descent initiated
<b>Enroute-cruise</b>	Fire/smoke (non-impact)
<b>Landing</b>	Collision during takeoff/land

### HISTORY OF FLIGHT

On May 11, 2012, approximately 1630 central daylight time, a Cessna 401 airplane, N9DM, collided with terrain near Chanute, Kansas. A post crash fire ensued. The commercial pilot and three passengers were fatally injured. One passenger was seriously injured. The airplane was substantially damaged. The airplane was registered to DRDJ Sales and operated by the pilot under the provisions of 14 Code of Federal Regulations Part 91, as a personal flight. Visual meteorological conditions prevailed for the flight which operated on an instrument flight rules plan. The cross-country flight departed the Richard Lloyd Jones Jr. Airport (RVS), Tulsa, Oklahoma, approximately 1545, for the Council Bluffs Municipal Airport (CBF), Council Bluffs, Iowa.

The survivor of the accident provided a written statement of the accident. She reported that when the pilot turned on the heater, a "terrible smell" was detected. The pilot told the passengers that the smell was normal for some heaters. When the pilot turned the heater off, dark, black smoke began to enter the airplane, which made it difficult to see. In an attempt to extinguish the fire, they poured water bottles in the vents, which had not effect. The pilot quickly descended. During the emergency landing, the pilot attempted to pull up, but the wing tip hit the ground first. The passenger thought the airplane rolled as it hit the ground. Another passenger assisted her in egressing from the airplane, but that survivor later succumbed to his injuries.

### PERSONNEL INFORMATION

The pilot, age 23, held a commercial pilot certificate with airplane single engine land, airplane multiengine land, and instrument airplane ratings. On June 28, 2011, a first class medical certificate was issued with the restriction "not valid for night flying or by color signal control." At the time of the pilot's application for a medical certificate he reported accumulating 600 total hours, with 50 logged in the preceding 6 months. On June 27, 2010, the pilot had applied for his commercial pilot certificate and on that application he reported 392.8 hour of total time. The pilot's logbook was not located during the course of the investigation.

### AIRCRAFT INFORMATION

The multi-engine airplane, N9DM, serial number 401-0123, was manufactured in 1967. It was powered by two turbo-charged, fuel injected, 300-horsepower, TSIO-520-E engines. Each engine drove a metal, 3-blade propeller. According to the airplane's logbooks, the last annual inspection was accomplished on January 15, 2012, at a Hobbs time of 2,455.5 hours. This inspection had a remark, "heater is inop[erative]." A sales advertisement, dated January 8, 2012, listed the airframe's total time as 4,819 hours. Including the time the pilot flew for his insurance requirements, the airframe had accumulated at least 4,831 hours.

## METEOROLOGICAL INFORMATION

At 1652, an automated weather reporting facility located at the Chanute-Martin Johnson Airport (KCNU), Chanute, Kansas, 6 nautical miles east of the accident site, reported wind from 180 degrees at 4 knots, visibility 10 miles, a broken ceiling at 11,000 feet, temperature 21 degrees Celsius (C), dew point 15 C, and a barometric pressure of 30.07 inches of mercury.

## COMMUNICATIONS

The pilot was under radar and radio contact with Kansas City Air Route Traffic Control Center (ARTCC) and at 1606 reported that the airplane was level at 10,000 feet. The pilot requested and was approved to proceed direct to CBF. At 1624, the pilot requested a descent from 10,000 to 8,000 to "get out of the clouds and turbulence," which was approved. ARTCC then issued a frequency change which was acknowledged by the pilot. The pilot did not make radio contact with the next controller, and there were no further communications with the pilot. In addition, no distress calls were heard by ARTCC controllers or other pilots on either ARTCC frequency.

## WRECKAGE AND IMPACT INFORMATION

The accident site was in a line of trees between a grass field and a corn field. The debris path was aligned along a 277 degree magnetic heading. The first impact point was a narrow ground scar consistent with a wing tip strike. Near the impact point was a portion of the right wing tip. About 88 feet down the wreckage path were two ground scars of varying lengths. No other ground scars were found leading to the main wreckage.

The main wreckage came to rest in a tree line about 162 feet from the initial impact scar, in the upright position, facing east. A post-crash fire had consumed a majority of the fuselage. All of the airframe's flight control surfaces were accounted for at the accident site.

The left wing remained attached to the fuselage. However, just outboard of the engine nacelle, the wing was torn and fragmented. The left engine separated from the nacelle and was located behind the left wing. The right wing remained attached to the fuselage and was crushed rearward and folded along its length. The outboard portion of the wing was bent upward and twisted rearward. The right engine had separated from its nacelle and was located 105 feet

west of the main wreckage.

The vertical stabilizer was torn and twisted. The rudder was torn and separated from the vertical stabilizer, but remained attached to the fuselage via the control cables. The vertical stabilizer and elevator had separated from the empennage and were beneath the tail portion of the airplane. Flight control continuity was established to all flight controls.

The flaps were set to 15 degrees. The landing gear was in the retracted position. Portions of acrylic glass from the forward wind screens were found east of the wreckage in an area not exposed to the post-crash fire. These portions of acrylic glass contained soot on the cabin side surface. The cockpit gauges were impact and thermally damaged and did not convey reliable information. Both fuel selector valves were examined and found in the OFF position.

The left propeller had separated from the propeller hub and was found near the right wing. All three blades were relatively straight with one blade bent rearward near its mid-span. All three blades had soil and debris on the blade tips. The right propeller remained attached to the propeller hub. All three blades displayed leading edge polishing and damage near the blade tips. The blades were labeled A, B, and C, for documentation purposes only. Blade A was bent rearward just outboard of the blade root and bent forward near its 2/3 span. Blade B was bent forward towards the cambered side. Blade C was curled towards the cambered side near its mid-span.

## MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy was performed on the pilot as authorized by the Wilson County Coroner's Office. The cause of death was a result of thermal injuries. The autopsy found no indication of physical or toxicological impairment.

Forensic toxicology was performed on specimens from the pilot by the FAA Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma. A reading of 12% carbon monoxide was detected in the pilot's blood. Testing did not detect the presence of cyanide, ethanol, or other tested substances.

## TEST AND RESEARCH

### Engine runs

Both engines were shipped to Continental Motors Inc., Mobile, Alabama. Under the auspices of the NTSB, the engines were examined and prepped for engine runs. Each engine started and produced rated horsepower. No preimpact anomalies were detected with either engine.

### Airplane Heater

The airplane was equipped with a South Wind 8259GL-1 combustion heater, serial number 388,

which was last overhauled on February 11, 1994. Airplane logbooks recorded the heater's installation on October 17, 1996, with a heater Hobbs time of 126.4 hours and Airworthiness Directive (AD) 81-09-09 accomplished. A review of the logbook did not find any additional entries for heater Hobbs time or compliance with AD 81-09-09.

On January 6, 2011, an annual inspection was accomplished and the heater was mistakenly identified as a Janitrol heater. This entry listed the heater as inoperative. A work order, dated February 9, 2011, described work performed on the heater: "Troubleshoot cabin heater. Found that cause of no fuel to fuel pump was due to no electrical power to fuel safety valve. Found stuck airflow switch, cleaned and heater operated normally." There was not a log book entry that returned the heater to service. In addition, there was no evidence that a pressure decay test was accomplished. The heater Hobbs was destroyed in the accident and the heater's hours could not be verified.

For insurance purposes, the pilot was required to fly with a certificated flight instructor (CFI) for at least 12 hours to obtain familiarization in the airplane make and model. In a telephone interview with the CFI, he recalled that during a flight on April 25, 2012, the heater's overheat light illuminated shortly after they activated the heater. The heater shut down and no smoke or fumes were detected by the flight crew, so they continued to their destination. At the destination, the CFI demonstrated to the pilot how to reset the circuit breaker. He stated that they performed the return flight without utilizing the heater. Although they flew at least one additional flight on May 2, the CFI did not know any further information about the heater. The pilot's father (a retired airline pilot) had flown with the pilot on May 6, in the accident airplane. He did not recall any placard on the heater and the pilot had not mentioned any problems with the heater to his father. Fire damage to the heater switch area prevented an evaluation of any placards.

Cessna's Model 401 Owner's Manual states that when the overheat warning light is illuminated, the heater overheat switch has been actuated and the temperature of the air in the heater has exceeded 325 degrees Fahrenheit. Once the heater switch is actuated, the heater turns off and cannot be restarted until the overheat switch, located in the right forward nose compartment, has been reset. Prior to having the overheat switch reset, the heater should be thoroughly checked to determine the reason for the malfunction.

There is no record of work being accomplished on the accident airplane after the overheat light had illuminated. Neither of the airplane's home airfield repair shops performed work on the accident airplane. The fixed base operator did not recall seeing any personnel performing work on the airplane in the days preceding the accident.

Cessna's service manual for the Cessna 401 listed the causes of "heater trips over heat switch" as a defective overheat switch or insufficient vent air and a defective duct limit switch. The corrective action is to replace the overheat switch or replace the duct limit switch and increase the air rate, respectively.

## South Wind Heater exam

The heater was examined at Cessna Aircraft Company under the auspices of the NTSB and FAA. The heater displayed signatures of thermal damage. When the igniter housing assembly was removed, thermal damage was noted to the ignition unit and spark plug. The spark plug displayed heavy sooting. The heater's shroud was removed and the duct limit switch was found to be misaligned. Discoloration on the switch surface suggested a misalignment prior to heat discoloring the metal. The combustion chamber's interior was heavily sooted and contained several large pieces of carbon deposits and debris. The heater was reassembled with and sealed through the use of a general sealant. Attempts to perform a pressure decay test were unsuccessful. Utilizing a soap and water mixture and pressurization, at least four portions of the combustion chamber displayed signs of leaks. At least three leaks existed on welded joints and one leak around the igniter tip.

### Compliance with Airworthiness Directive (AD) 81-09-09

After compliance with AD 81-09-09, the heater is required to be inspected every 250 hours of use and overhauled every 1,000 hours. Unlike comparable combustion heaters, there is no calendar time limits which would require an inspection. If the inspection is not completed or the heater is inoperative, there is no guidance in the AD to disable the heater in a manner that it can no longer be activated in airplane. In contrast, a similar heater's AD requires a visual inspection every 100 hours or 1 year. That AD also provides steps to disable the heater in a manner that it can no longer be used, if the heater fails inspection or as an alternate compliance to the AD.

### Pilot Information

<b>Certificate:</b>	Commercial	<b>Age:</b>	23, Male
<b>Airplane Rating(s):</b>	Single-engine land; Multi-engine land	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	Yes
<b>Medical Certification:</b>	Class 1 With waivers/limitations	<b>Last FAA Medical Exam:</b>	June 28, 2011
<b>Occupational Pilot:</b>	UNK	<b>Last Flight Review or Equivalent:</b>	
<b>Flight Time:</b>	(Estimated) 613 hours (Total, all aircraft), 13 hours (Total, this make and model), 13 hours (Last 30 days, all aircraft)		

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Cessna	<b>Registration:</b>	N9DM
<b>Model/Series:</b>	401	<b>Aircraft Category:</b>	Airplane
<b>Year of Manufacture:</b>		<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Normal	<b>Serial Number:</b>	401-0123
<b>Landing Gear Type:</b>	Retractable - Tricycle	<b>Seats:</b>	7
<b>Date/Type of Last Inspection:</b>	January 15, 2012 Annual	<b>Certified Max Gross Wt.:</b>	6300 lbs
<b>Time Since Last Inspection:</b>		<b>Engines:</b>	2 Reciprocating
<b>Airframe Total Time:</b>	2455.5 Hrs as of last inspection	<b>Engine Manufacturer:</b>	Teledyne Continental Motors
<b>ELT:</b>	Installed	<b>Engine Model/Series:</b>	TSIO-520-E
<b>Registered Owner:</b>	DRDJ Sales Inc.	<b>Rated Power:</b>	300 Horsepower
<b>Operator:</b>	Private Individual	<b>Operating Certificate(s) Held:</b>	None

## Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Visual (VMC)	<b>Condition of Light:</b>	Day
<b>Observation Facility, Elevation:</b>	KCNU,1002 ft msl	<b>Distance from Accident Site:</b>	6 Nautical Miles
<b>Observation Time:</b>	16:52 Local	<b>Direction from Accident Site:</b>	74°
<b>Lowest Cloud Condition:</b>	11000 ft AGL	<b>Visibility</b>	10 miles
<b>Lowest Ceiling:</b>	Broken / 11000 ft AGL	<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	4 knots /	<b>Turbulence Type Forecast/Actual:</b>	/
<b>Wind Direction:</b>	180°	<b>Turbulence Severity Forecast/Actual:</b>	/
<b>Altimeter Setting:</b>	30.06 inches Hg	<b>Temperature/Dew Point:</b>	21°C / 15°C
<b>Precipitation and Obscuration:</b>	No Obscuration; No Precipitation		
<b>Departure Point:</b>	Tulsa, OK (RVS)	<b>Type of Flight Plan Filed:</b>	IFR
<b>Destination:</b>	Council Bluffs, IA (CBF)	<b>Type of Clearance:</b>	IFR
<b>Departure Time:</b>	15:45 Local	<b>Type of Airspace:</b>	



## Wreckage and Impact Information

<b>Crew Injuries:</b>	1 Fatal	<b>Aircraft Damage:</b>	Substantial
<b>Passenger Injuries:</b>	3 Fatal, 1 Serious	<b>Aircraft Fire:</b>	On-ground
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	None
<b>Total Injuries:</b>	4 Fatal, 1 Serious	<b>Latitude, Longitude:</b>	37.638332,-96.613052

## Administrative Information

<b>Investigator In Charge (IIC):</b>	Aguilera, Jason
<b>Additional Participating Persons:</b>	Kevin Donohue; FAA FSDO; Wichita, KS Jan Smith; Cessna Aircraft Company; Wichita, KS Chris Lang; Continental Motors; Mobile, AL Jerry Unruh; FAA FSDO; Wichita, KS
<b>Original Publish Date:</b>	September 5, 2013
<b>Last Revision Date:</b>	
<b>Investigation Class:</b>	<a href="#">Class</a>
<b>Note:</b>	
<b>Investigation Docket:</b>	<a href="https://data.nts.gov/Docket?ProjectID=83610">https://data.nts.gov/Docket?ProjectID=83610</a>

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